HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Stillaguamish Coho Program
Species or Hatchery Stock:	Stillaguamish Fall Coho
Agency/Operator:	Stillaguamish Tribe
Watershed and Region:	Stillaguamish Watershed Puget Sound Area
Date Submitted:	June 31, 2000
Date Last Updated:	March 2, 2004

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Stillaguamish Coho Integrated Harvest/Recovery Program

1.2) Species and population (or stock) under propagation, and ESA status.

In the past, fall coho were propagated at the Tribe's Harvey Creek and Johnson Creek Hatcheries and at a satellite facility at the Navy's Jim Creek Hatchery. Wild broodstock and the progeny of wild broodstock were captured at the respective sites. The recently modified plan will focus on the capture of wild origin broodstock from Fortson Creek which is a tributary to the North Fork Stillaguamish.

Stillaguamish fall coho are defined as a depressed stock in the SASSI co-managers document.

1.3) Responsible organization and individuals

Name (and title): John Drotts, Natural Resources Director
On-site lead: Kip Killebrew, Enhancement Biologist
Agency or Tribe: Stillaguamish Tribe
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The coho program is operated by the Stillaguamish Tribe, The Northwest Indian Fisheries Commission provides technical support for harvest and fish health issues. The Washington State Department of Fish and Wildlife is a co-manager of the Stillaguamish River natural coho stocks.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Bureau of Indian Affairs 638 Funding-$105,000; Hatchery staff include a enhancement biologist, hatchery manager, and a fisheries technician/office support person.

1.5) Location(s) of hatchery and associated facilities..

The following hatcheries are located within the Stillaguamish watershed (WRIA 05):

Stillaguamish Tribe's Harvey Creek Hatchery located 2 miles upstream of the mouth of Harvey/Armstrong Creek (WRIA 05.0126), which is located 15.3 miles upstream of the mouth of the Stillaguamish main stem (05.0001).

Stillaguamish Tribe's North Fork/Johnson Creek Hatchery located approximately 2.5 miles upstream of the mouth of Johnson Creek (WRIA 05. 0170A) located on the North Fork Stillaguamish.

The coho program at the US Navy's hatchery at Jim Creek has been terminated.

1.6) Type of program.

The Stillaguamish coho program has been changed to an integrated harvest/recovery program.

1.7) Purpose (Goal) of program.

The goal of this program is to provide for a limited selective terminal area fishery for tribal members during years when natural escapement requirements would not normally allow for a tribal fishery and to provide for a natural origin broodstock program for restoration activities within the basin.

1.8) Justification for the program.

The program will utilize wild broodstock from a stable productive tributary (Fortson Creek) to create both a wild indicator stock to compare the efficacy of using existing North Sound hatchery coho stocks as indicator stocks to represent wild North Sound coho. And, in addition, returning ad clipped, coded wire tagged coho will be available for a selective terminal area fishery that will have a minimal impact on weak runs of returning naturally spawning Stillaguamish coho. Returning adults that are not captured in the fishery would return to either the hatchery or the Fortson Creek fish ladder where they would be captured and sampled for coded wire tags and be available for spawning for restoration reseeding if needed.

1.9) List of program "Performance Standards".

Please refer to Appendix A.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Please refer to Appendix A.

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Please refer to Appendix A.

1.10.2) "Performance Indicators" addressing risks.
Please refer to Appendix A.

1.11) Expected size of program.

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1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The target broodstock level for Fortson Creek coho would be 45 pairs of fish.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Stillaguamish watershed	53,500

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Broodyear	River Escapement	Recruits/Spawner	Hatchery Broodstock Level
1988	14,500	0.63	50
1989	7,000	3.12	12
1990	18,000	0.72	32
1991	6,100	7.52	107
1992	13,200	1.64	8
1993	10,400	N/A	117
1994	26,100	N/A	262
1995	22,800	N/A	50
1996	10,400	N/A	20
1997	10,900	N/A	56
1998	27,300	N/A	10
1999	7,000	N/A	6

1.13) **Date program started (years in operation), or is expected to start.**

The coho program began with wild broodstocking in 1986.

1.14) Expected duration of program.

The program is expected to continue until Stillaguamish coho natural production has recovered to levels that will sustain consistent terminal tribal fisheries and other non-consumptive fish benefits.

1.15) Watersheds targeted by program.

The Stillaguamish watershed (WRIA 05) is the targeted watershed for this program.

1.15) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The alternative to the integrated harvest/recovery program is the recovery of natural production through improved habitat conditions and reduced harvest levels. The co-managers have continued to reduce harvest rates from 70% to 80% during the 1986-91 period down to harvest levels of 17% or less during 1993-95(Drotts, per. comm.).

The co-managers have completed a coho limiting factors analysis and a chinook limiting factors analysis as part of the 2496 limiting factors analysis for salmonids within the watershed.

Key factors impacting the natural production of coho in the basin include changes in peak flow/low flow hydrology where the historic 20 year flood event is now the 2 year event (Beamer et al. 2000). Some of the highest winter flows and lowest summer flows on record have occurred during the past 20 years (Pess et at ,1997). Over 70% of the basin has been logged since the turn of the century with an estimated 50% of the watershed currently being in a degraded hydrologic condition(Pollack, 1997). 1083 landslides have slipped more than 3 million cubic yards of sediment into the Stillaguamish (Collins et al, 1997). Beaver pond and slough habitat have been reduced by more than 60% from historic levels (Pollack et al, 1999). Historic estuary habitat has been reduced by more than 80% (Pess et al., 1997) and historic wetland habitat has been reduced by 76% (Gersib, 1997).

Recovery and restoration plans are being implemented and developed. However, the large extent over which habitat degradation has occurred will require significant amounts of time and money to restore. The integrated harvest/restoration program is intended to provide a small consistant harvest opportunity for tribal fishermen within the basin until such time that survival and productivity improve to self-sustaining, healthy levels.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

A Section 7 or 4(d) Exemption is anticipated for the chinook US/Canada Indicator and Natural Stock Restoration Program currently under propagation at the Harvey Creek

Hatchery.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) <u>Description of ESA-listed salmonid population(s) affected by the program.</u>

- **Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.**
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  There are no ESA-listed populations that will be directly affected by this coho program.

- Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

ESA-listed populations of bull trout and chinook salmon may be incidentally affected by the coho program through interactions occurring during the release period for coho and during the harvest of returning program fish.

2.2.2) <u>Status of ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds*).*

- **Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**
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  Please refer to the Hatchery Genetic Management Plan for Chinook for this information.

- **Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**
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  Please refer to the Hatchery Genetic Management Plan for Chinook for this information.

- **Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

  Please refer to the Hatchery Genetic Management Plan for Chinook for this information.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

There is a potential for the take of listed bull trout and chinook fry / smolts associated with the release of coho smolts. Several researchers have documented the concentration of predators and increased predation rates during spring hatchery releases of salmon.

In addition, research has documented both hatchery and wild coho smolts preying upon wild chinook fry (Hawkins, 1998).

The release of an estimated 50,000 coho smolts will not pose a significant risk to existing naturally spawning chinook and bull trout. Natural smolt outmigration estimates by WDFW, documented over 300,000 coho smolts emigrating from the Stillaguamish during 1981–82 (Seiler, 1982).

-Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Both bull trout and chinook have just been recently listed, so there have been no past takes of either of these species. There have been no known mortalities of either chinook or bull trout as a result of running the coho program.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take). Complete the appended "take table" (Table 1) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.**

Please see Table 1 for details

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Harvest management plans are developed each year to minimize incidental take of chinook during terminal area coho fisheries.

Yearling coho are released at a time and size which maximizes their potential for smoltification thereby increasing their migration rate and reducing their fresh water residency time which will minimize their potential interactions with outmigrating bull trout and chinook.

During the spring of 2004, tribal natural resources staff will do stomach analysis on 100-150 mixed hatchery and wild coho smolt outmigrants at the smolt trap operated in the lower mainstem Stillaguamish River.

Should stomach analysis document predation of chinook juveniles by outmigrating hatchery and wild coho smolts, hatchery staff would modify the release period for coho from the hatchery program to further mimimize predation on chinook juveniles.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies. Explain any proposed deviations from the plan or policies.

The coho program is operated consistent with the Puget Sound Salmon Management Plan and the Salmonid Disease Control Policy of the Co-managers.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Puget Sound Salmon Management Plan

3.3) Relationship to harvest objectives.

The Stillaguamish watershed is managed for coho natural production, and harvest rates are established to meet natural escapement goals. Program coho return primarily to the terminal catch area where they will be harvested and to the tributaries where they are released and spawn in the area where their parents were captured.

Incidental takes of chinook salmon during terminal coho fisheries are less than 50 fish annually and incidental takes of chinook during chum and steelhead fisheries are typically less than 28 fish for the most recent harvest seasons (Rawson, per.comm.)

Adult bull trout typically return to the Stillaguamish during May through August(Kraemer, per. comm.). Currently, there are no directed tribal commerial or ceremonial fisheries held during that time. Chinook broodstocking does occur in the upper North Fork Stillaguamish during that time period, but bull trout are rarely captured (<10 fish from 1987- 1997) and are released alive(Drotts, per. comm.).

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Stillaguamish Coho Harvest Rates from WDFW Run Reconstruction

Year	Harvest Rate
1988	49.4%
1989	55.5%
1990	55.9%
1991	64.5%
1992	33.3%
1993	17.2%
1994	15.5%
1995	13.1%

Run reconstruction during the 1988-95 only includes harvest occurring from the Straits of Juan de Fuca in to the terminal area (Drotts, per.comm.).

3.4) Relationship to habitat protection and recovery strategies.

Coho salmon within the Stillaguamish watershed spawn in tributary habitat throughout most of the basin. Their extensive geographic range in both larger and smaller tributaries helps to somewhat buffer the population from the significant land use degradation that has occurred within the watershed.

Recovery plans being developed for ESA listed chinook are expected to also improve coho salmon freshwater survival as well.

Please see Section 1.15 of this report and Section 3.4 of the Chinook Hatchery Genetic Management Plan for detailed habitat condition information.

3.5) Ecological interactions.

Species that could negatively impact the coho program include most of the predators associated with eating salmon both as juveniles and as a adults. These may include: a). mammals such as seals, river otters, and orcas; b). birds such as mergansers, herons and cormorants; c). fish such as yearling coho, steelhead, cutthroat.

Species that may be negatively impacted by the program include other outmigrant salmonid species that are in the area during coho releases and the incidental take of other adult salmon species during the harvest of returning coho salmon.

Species that might positively impact the program are the kingfishers and herons that are provided limited predator exposures to program coho prior to release potentially increasing the survival of the remaining fish at outmigration.

Species that are positively impacted by the program are many terrestrial and all salmonid and non-salmonids that derive benefit both directly and indirectly from the marine derived nutrients that returning adult coho salmon distribute through out most of the basin.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Incubation and early rearing water comes from a 65 foot deep well providing 150 gpm, while the main water supply is an intake structure in Harvey Creek. Water temperatures for the well range 49 to 52 F. Surface water temperatures range from 35 to 58 F and dissolved oxygen levels range from 8.2 to 14.1 ppm.

Flow rates:

Harvey Creek Hatchery
Incubation stacks-3 to 5 gpm per stack (well water)
Smaller circular tanks -45 to 65 gpm (surface)
Larger circular tanks- 150 to 200 gpm (surface)

North Fork Hatchery
Large acclimation pond—200-400 gpm(surface)

The following water characterization data comes from Don Klopfer of the Stillaguamish Tribe's Natural Resources Department. Detailed chemical analysis of each source is available upon request.

Well/Spring Water characterizations

Harvey Creek Hatchery well water is a groundwater source with no known surface water influences. Harvey Creek Hatchery well water is soft water. Seasonal changes and characterizations for this water source have not been documented

Surface Water Characterizations

The North Fork Stillaguamish River at Whitehorse and Harvey/Armstrong Creek at the Harvey Creek Hatchery are predominately surface water sources with limited ground water influences. Both of the above surface water sources are characterized as very soft with limited mineral content. Seasonal variations are similar for both sources with the percentage of groundwater influence increasing during summer low flows.

Based on preliminary, conventional water quality data analysis, there are not significant chemical differences in any of these water sources for the purposes of fish rearing.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The Harvey Creek Hatchery has 1/8-inch diameter circular perforated screen at its intake structure and currently meets Level One NPDES discharge standards for facilities rearing

less than 10,000 pounds annual production.

The North Fork Hatchery intake is above an anadromous barrier and the intake will be updated during 2004-05 to meet current requirements.

All water used for the fish rearing facility is returned to receiving waters very close to where it was withdrawn.

Both Harvey Creek Hatchery and the North Fork Hatchery meet Level 1 NPDES requirements for having in line settling basins where fish waste is settled out prior to returning the pond water back to the stream.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock are either captured in a fish trap located in the fish ladder at Fortson Creek mill pond outlet or immediately below the trap. Once fish are removed from the trap, they are transferred to the fish transport truck using wet burlap bags and hauled back to the Harvey Creek hatchery for spawning .

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Transportation occurs in standard hatchery insulated fiberglass fish hauling truck. Maximum hauling numbers are 80 fish per 860 gallons of water. Compressed oxygen is provided during transport. Spare oxygen tanks are carried on the truck and oxygen flow to the tanks can be monitored from the cab while driving. Salt is added during transport as a therapeutic treatment. Hauling times do not exceed 2 hours from loading to unloading.

5.3) Broodstock holding and spawning facilities.

The Harvey Creek Hatchery has 4 discrete holding ponds for keeping broodstock separated by sex and for sorting ripe and unripe fish. Four 13 ft. diameter by 4 ft. deep circular tanks have a volume of 450 cubic feet and a flow of 45 to 65 gallons per minute. Surface water from Harvey Creek is used for all circulars.

Starting with brood year 2003 spawning will occur in a new isolated spawning shed with effluent going into a septic system.

5.4) Incubation facilities.

Incubation occurs in vertical heath trays that are supplied with well water from a 65 foot deep well. Water flows from the well into a de-gas tower and then to a head box where individual valves control flow rates of 3 to 5 gallons per minute per 8 tray stack. Trays are double stacked and a second intake line adds additional water to the bottom eight trays

5.5) Rearing facilities.

Early rearing

Swim up fry are transferred to 4 shallow netart early rearing troughs that are 24 ft. long, 3.6 ft. wide and 1.5 ft. deep. Well water serves these troughs and ranges from 15 to 25 gallons per minute per trough. Fry are reared in these troughs for approximately 30 days and then transferred outside to above ground circular tanks.

Beginning in 2003 new deep early rearing troughs will be installed to reduce early rearing densities to acceptable levels.

Fish are transferred and reared at the Harvey Creek Hatchery in covered, brown circular tanks. These tanks provide continuous current, color and cover more representative of in-river holding pool habitat. Fish are more evenly distributed throughout the container and food tends act more like natural stream drift than in a conventional raceway.

5.6) Acclimation/release facilities.

Final acclimation will occur at either the North Fork Hatchery or Harvey Creek Hatchery depending on programming space requirements. Pre-release fish will receive a one month exposure of phenethyl alcohol at 3 x 10neg3 mg/liter for imprinting. Chemical imprinting will direct returning adults into an isolated terminal area (Triangle Cove) for harvest where incidental capture of wild Stillaguamish coho is minimized. Triangle Cove is an isolated cove located 3 miles across Port Susan on the opposite side from where the mouth of the Stillaguamish River is.

During some years, a portion or all of the coho reared may be released in newly created habitat resulting from the removal of fish passage barriers. These releases would assist in jump starting coho spawning and rearing in these areas.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.
5.8)

There have been periodic losses of significant numbers of eggs, swim up fry and pre-release fry due primarily to Saprolegnia and coagulated yolk . Bacterial kidney disease, coldwater disease and costia have consistently caused significant mortality during most years. Past predator losses at the North Fork Hatchery have also been significant.

Changes have been made to the program to correct elevated mortality problems. Adult female coho receive injections of erytromycin to reduce the level of BKD in their offspring. Predator nets and an electric fence were installed. River otter have continued to be a problem at the North Fork Hatchery even with an electric fence. During the summer of 2003, a 4 foot high chain length fence will be installed to keep otters out of the large acclimation pond.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

The Harvey Creek Hatchery has an extensive alarm system with triple flow sensors on the well and incubation/early rearing trough water system. The system was significantly up graded in 1997 after an alarm system failure that resulted in a significant loss of alevins for that broodyear. There are flow alarms on all gravity fed circular tanks with 2 central lines feeding each set of tanks. The alarm system includes a high water/flooding alarm to alert staff to possible flooding conditions. The hatchery is completely surrounded by a 6-foot high razor fence to restrict access. The main incubation well water pump has a double backup, with surface water being pumped by either a gasoline pump or the backup generator. Should the gravity feed water supply fail, the hatchery has multiple oxygen tanks, regulators and O2 stones to provide emergency oxygen until the flow problems can be resolved.

The North Fork Hatchery has a gravity feed water supply with backup oxygen delivery system during low flows. Bird netting and new chain link fencing will be installed to further reduce predation problems in the large pond.

During 2005-06 an flow alarm system will be installed in conjunction with the intake improvements being completed during the 2004 construction season.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Broodstock Source.

Historic broodstock sources for the Harvey Creek and North Fork Hatcheries have come from natural spawners and offspring from Harvey Creek, Johnson Creek, Fortson Creek and Jim Creek.

Beginning in 2004, all broodstock will be captured from Fortson Creek, a tributary to the North Fork Stillaguamish.

The SASSI stock status for Stillaguamish fall coho is defined as depressed.

6.2) Supporting information.

6.2.1) History.

Previous broodstock sources were collected from streams that had coho rearing facilities(Harvey Creek, Johnson Creek, Jim Creek) or from a tributary that had a consistent, healthy run of returning adults(Fortson Creek).

At the recommendation of the HSRG review panel, one tributary will be used for the coho program rather than mixing multiple stocks.

6.2.2) Annual size.

The annual target for broodstocking is 45 pairs of adults from Fortson Creek.

6.2.3) Past and proposed level of natural fish in broodstock.

During the 1978-82 period all broodstock were wild origin. From 1986 until 2002, there was a mix of both wild coho and returning hatchery coho used as broodstock. Beginning in 2004, all adult coho broodstock will be naturally spawning fish from Fortson Creek.

6.2.4) Genetic or ecological differences.
Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

There are no known genetic or ecological differences between the natural spawning population and the hatchery stock currently being used.

6.2.5) Reasons for choosing.
Describe any special traits or characteristics for which broodstock was selected.

Fortson coho are being chosen because there is a healthy, stable run of fish returning to the stream. This run of coho is representative of other coho tributaries within the Stillaguamish based on the adult return timing and juvenile outmigration (Henderick and Nelson, per. comm.). This stock will be tagged as an indicator stock to compare wild origin coho with existing hatchery coho stocks that are currently used as indicator stocks for North Puget Sound wild coho populations.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.
(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program*.").

Fortson Creek does not support a spawning population of chinook. Coho broodstocking would occur in a time period after chinook spawning is over.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Only adult coho salmon will be collected.

7.2) Collection or sampling design.

Returning adults are captured during the peak period that fish are returning. Fish begin entering the tributaries of the Stillaguamish in late October and peak in mid November depending of the flow conditions.

7.3) Identity.

Capture location is the key method used to identify the population to be spawned.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The coho program goal is to collect 45 pairs of Fortson Creek coho.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988	25	25			
1989	6	6			
1990	16	16			
1991	53	54			
1992	0	0			
1993	57	60			
1994	131	131			
1995	25	25			
1996	10	10			
1997	26	30			
1998	8	8			
1999	6	6			

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Only natural spawners are captured and broodstocking levels have been set to be less than 20% of the average returning escapement for the watershed.

7.6) Fish transportation and holding methods.

Transportation of coho occurs in standard hatchery insulated fiberglass fish hauling truck. Maximum hauling numbers are 80 fish per 860 gallons of water. Compressed oxygen is provided during transport. Spare oxygen tanks are carried on the truck and oxygen flow

to the tanks can be monitored from the cab while driving. Salt is added during transport as a therapeutic treatment. Hauling times do not exceed 2 hours from loading to unloading.

Some of the coho that are captured are held in circular fiberglass tanks for up to 4 weeks until ripe.

7.7) Describe fish health maintenance and sanitation procedures applied.

Females are sampled for disease by pathology staff from the NWIFC. All broodstocking, transport, handling, and spawning equipment is disinfected with a solution of 100 ppm active iodine.

7.8) Disposition of carcasses.

Carcasses are either given to tribal members and staff or donated to the local wildlife rehab center. Carcasses that are injected with erythromycin are either given to the wildlife care center for wild animal feeding or buried.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstocking will occur at locations that do not have known chinook spawning and during a time period after when chinook are known to spawn in the basin

Female broodstock will be injected with erythromycin to reduce the prevalence of BKD in their offspring

The spawning protocols will follow the guidelines in the Salmonid Disease Control Policy.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Fish in the holding ponds are checked once a week for ripeness. All fish ready that day are killed and spawned.

8.2) Males.

A 5 X 5 spawning matrix will be used with a backup male used for each pool of female eggs.

8.3) Fertilization.

Five females will be spawned and their eggs combined, mixed and then separated into 5 different containers. One primary and one backup male will be used for each container of mixed eggs.

8.4) Cryopreserved gametes.

There is no cryopreservation.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

There are no known adverse genetic or ecological effects to listed species from the coho spawning protocols used.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Year	Estimate Green Egg Take	Survival to Eyed Stage
1988	42,500	90%
1989	10,200	80%
1990	27,200	83%
1991	90,700	60%
1992	0	0
1993	96,100	70%
1994	196,000	60%
1995	40,000	80%
1996	17,000	75%
1997	44,000	70%
1998	8,000	80%
1999	12,000	80%

Source of data: Kip Killebrew, Stillaguamish Tribe

9.1.2) Cause for, and disposition of surplus egg takes.

Any surplus eggs would be culled at the eyed egg stage.

9.1.3) Loading densities applied during incubation.

Loading densities range from 6,000 to 8,000 coho eggs per tray. Flows range from 3 to 5 GPM.

9.1.4) Incubation conditions.

Incubation water is well water that is run through a packed column to add oxygen. Dissolved oxygen levels range between 10 and 11 ppm. Loading densities are within the standards currently used by most hatcheries. Silt management is not required unless surface water is used in an emergency where well water is not available. Well water temperatures typically range between 49 and 52 F.

9.1.5) Ponding.

Button up and ponding occurs when there is no belly slit remaining on the majority of the alevins in a given incubator tray.

9.1.6) Fish health maintenance and monitoring.

Eggs are treated on an as needed basis with hydrogen peroxide at 500 ppm for 15 minutes or formalin at 1600 ppm for 15 minutes to control fungus development.

Coldwater disease and coagulated yolk are the primary problems seen at the hatchery. The problems are not consistently seen, but do periodically cause significant mortalities.

Non-viable eggs are removed at the eyed stage after shocking using a Jensorter Model WB-4 optical egg sorter. Remaining dead eggs are removed and counted at the time of ponding.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Standard disease control guidelines are followed as recommended in the co-managers Salmonid Disease Control Policy.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

BY	Green egg to ponding	Green egg to release	Comments
1988	0.9	0.88	
1989	0.8	0.49	BKD and Coldwater disease
1990	0.83	0.61	
1991	0.6	0.27	BKD ,Coldwater disease, Intake water failure
1992	0	0	
1993	0.7	0.36	BKD and Coldwater disease
1994	0.6	0.22	BKD , Costia, Coldwater and Predator problems
1995	0.8	0.29	BKD, Coldwater and Predator problems
1996	0.75	0.42	BKD, Costia, Coldwater and Predator problems
1997	0.7	0.18	Costia, Predator problems
1998			
1999			

Note: During 1997, adult coho females began receiving erythromycin injections to reduce the problem of BKD in their offspring , new predator control equipment was installed and the coho rearing location was changed to Harvey Creek Hatchery.

9.2.2) Density and loading criteria (goals and actual levels).

Current early rearing densities exceed recommended targets by greater than 100%. Beginning in 2003, new early rearing troughs will be on line and early rearing densities will meet our overall rearing loading criteria of less than 1.2 lbs/GPM/inch and less than .25 lbs/cubic ft./inch.

9.2.3) Fish rearing conditions

Coho fry are transferred out to the 14 ft. diameter circular fiberglass tanks during February and March. Fish are monitored for growth typically twice a month and have fish health checks once per month until release. The fish are on Harvey Creek surface water and experience temperatures ranging between 38 F to 50F during their rearing time. Dissolved oxygen levels are monitored monthly at the hatchery intake. Tanks are cleaned on an as needed basis using a standard swimming pool type vacuum system.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available

Feb fish at 818/lb; March fish at 650/lb;May fish at270/lb; June fish at 174/lb;July fish at 83/lb;Sept. fish at 60/lb;Nov fish at 40/lb;Jan fish at 30/lb;Mar. fish at 20/lb;May fish at 18/lb.

9.2.5) Indicate monthly fish growth rate and energy reserve data.

This information is not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing.

As swim up fry, fish are fed BioDiet Starter 7 times a day at approximately 2.5% B.W./day. At 700/lb, fry are fed BioDiet Starter 4 times a day at approximately 2.5% B.W./day. When fish reach 500/lb, they are fed BioMoist Feed 3 times a day at approximately 2.3% B.W./day. Once the fish reach 100/lb, they are fed BioMoist feed two to three times a day at between 2.7% to 1.6% body weight depending on water temperatures and growth rate.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Each year, fish pathologists screen a representative number of adults returning to tribal hatcheries for pathogens that may be transmitted to the progeny. The exact number of fish to be tested from each stock is specified in the Co-managers Salmonid Control Policy. Pathologists work with hatchery crews to help avoid pre-spawning mortality of brood fish to maximize fertilization and egg survival.

Preventative care is also promoted through routine juvenile fish health monitoring. Pathologists conduct fish health exams at each of the tribal hatcheries on a monthly basis from the time juveniles swim-up until they are released as smolts. Monthly monitoring exams include an evaluation of rearing conditions as well as lethal sampling of small numbers of juvenile fish to assess the health status of the population and to detect pathogens of concern. Results are reported to hatchery managers along with any recommendations for improving or maintaining fish health. Vaccine produced by the TFHP may be used when appropriate to prevent the onset of two bacterial diseases (vibriosis or enteric redmouth disease). In the event of disease epizootics or elevated mortality in a stock, fish pathologists are available to diagnose problems and provide treatment recommendations. Pathologists work with hatchery crews to ensure the proper use of drugs and chemicals for treatment. The entire health history for each hatchery stock is maintained in a relational database called AquaDoc. (Northwest Indian Fisheries Commission Fish Pathology pers.comm.)

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

There is no smolt developmental indices data available for this stock.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Early rearing occurs in circular brown fiberglass tanks with covers over the top. The constant current and cover are more representative of in river pool habitat. Feed acts more like drift and fish distribute themselves out more evenly than in straight raceways. Nets are periodically removed to allow predator exposure to king fishers.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Adult female broodstock will be injected with erythromycin to reduce the prevalence of BKD in offspring being reared in ponds near where listed chinook are being reared.

Hatchery operations will follow the Salmonid Disease Policy developed by the co-managers.

Coho will be released at size and time that maximizes smoltification to minimize their freshwater outmigration period.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	53,500	18-20 fpp	May 1st thru 15th	Harvey/Johnson Ck.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Harvey/Armstrong Creek (WRIA 05.0126*)*
Johnson Creek (WRIA 05.0170A

Release point: Harvey Creek Hatchery at river mile 3 on Harvey/Armstrong Creek
North Fork Hatchery at river mile 2 on Johnson Creek

Major watershed: Stillaguamish River (WRIA 05)

Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988							0	0
1989							0	0
1990							37,219	13/lb
1991							4,956	15/lb
1992							16,659	16/lb
1993							24,558	18/lb
1994							0	0
1995							34,260	18/lb
1996							43,000	18/lb
1997							11,618	17/lb
1998							7,220	17/lb
1999							8,022	13/lb
Average								

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

10.4) Actual dates of release and description of release protocols.

Coho will be volitionally released over 15 days during the first part of May when the fish have reached at least 20 fish per pound and are showing visual signs of smoltification. After the 15th, any remaining fish will be pushed out to drain the ponds.

10.5) Fish transportation procedures, if applicable.

Fish transportation occurs in a fiberglass insulated fish-hauling tank. Loading densities are less than 81 fish per 680 gallons of well water. Salt is added as therapeutic treatment and water temperatures are within 5 degrees Fahrenheit of the receiving water. Compressed oxygen is fed into the transport tank using a standard welding type regulator set at 10-14 psi. Oxygen levels can be monitored from inside the cab of the transport truck. Transit time is typically 1 hour.

10.6) Acclimation procedures (*methods applied and length of time***).**

Coho are acclimated in the same tanks/ponds that they are reared in.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Coho from the program will be 100% adipose clipped. Beginning in 2004 and contingent on funding, all coho will also be coded wire tagged as part of a wild indictor stock group.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

All fish reared are released and none are considered surplus.

10.9) Fish health certification procedures applied pre-release.

The standard Salmon Disease Control Policy guidelines are followed for pre-release fish health checks.

10.10) Emergency release procedures in response to flooding or water system failure.

Should emergency conditions arise that cannot be alleviated using the existing backup systems of pumps, compressed oxygen and fish transportation, then the fish would be released from their containers into the adjacent stream.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Coho releases occur when fish have reached a size in excess of 20 fish per pound and show visible signs of smoltification.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Please refer to Appendix A.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Please refer to Appendix A.

11.1.2) **Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Please refer to Appendix A.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Please refer to Appendix A.

SECTION 12. RESEARCH

12.1) Objective or purpose.

The Stillaguamish integrated harvest/recovery program is a production program and has no research currently associated with it other than the indictor stock tagging which is a fisheries management activity.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

SECTION 13. ATTACHMENTS AND CITATIONS

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Draft Document Under Development

Appendix A: Performance Standards, Indicators and Monitoring Tables

Program Goal:
Artificially propagated fish will provide fishing opportunities, while maintaining the abundance of an existing wild population and re-establishing natural spawning populations in tributaries where habitat has been recovered.

Justification:
Benefits:

- Produce fish to meet harvest needs
- Maintain the total abundance of the composite natural/hatchery population with an increasing trend of NOR's in restoration tributaries estimated to be greater than would have been the case without the natural stock restoration and habitat recovery. There should be a long term upward trend in overall natural escapement the Stillaguamish watershed.
-

Risk Avoidance:

- Produce adult hatchery fish that are similar to wild in life history traits
- Will maintain genetic diversity in the watershed and ESU

Sections 1.9 and 1.10. Table

Goal (Section 1.7-1.8)	Performance Standard (Section 1.9)	Performance Indicator (Section 1.10)
Produce fish to meet harvest needs	Hatchery production contributes to harvest and maintains Tribal Treaty harvest rights by providing surplus coho for terminal area fisheries	1. Estimate total harvest and effort for target fishery
		2. Estimate the contribution of hatchery fish to harvest in terminal target fishery
		3. Estimate exploitation rates of hatchery fish
		4. Estimate survival of hatchery production to target fisheries and escapement
Rearing practices maximizes survivals from egg to release	The rate of fertilization remains above a minimum of 80% and survival from egg to release above a minimum of 70%	5. Estimate the rate of fertilization and survival from egg to release
Maintain the total abundance of composite natural/hatchery population	The broodstock collected meets the goals set by hatchery management plan	6. Count the number of adults used for broodstock.
Produce adult hatchery fish that are similar to wild fish in life history traits.	Broodstock collection shall be carried out to minimize changes in life history traits	7. The age and sex composition of the broodstock collected for the hatchery does not differ significantly from the natural spawners
	The collection of broodstock occurs during the peak of the migration of the hatchery/natural returns	8. Estimate the timing of the return of adults
	Release practices do not alter the timing of outmigrant hatchery smolts from the timing of NOR production	9. Test the hypothesis that the mean timing of outmigration of hatchery smolts is not significantly different from that of NOR produced smolts
	Release practices do not alter the timing of returning adults	10. Test the hypothesis that the mean timing of HOR returning adults is not significantly different from that of NOR returns
	Release practices do not alter the spawning in distribution in area and time of HOR returns from the NOR distribution	11. Test the hypothesis that the proportional distribution of HOR spawners is the same as that of NOR
Maintain genetic diversity	The number of adults used for broodstock remains above the minimum effective population size.	12. Count the number of adults used for broodstock and note the size of the spawning matrix used.
	The HOR spawners in the hatchery broodstock remain below 20 percent.	13. Estimate the percent of HOR fish in the broodstock collected

Sections 1.9 and 1.10. Table

Goal (Section 1.7-1.8)	**Performance Standard** (Section 1.9)	**Performance Indicator** (Section 1.10)
	The hatchery production and practices do not alter the genetic characteristics of the NOR population.	14. Test the hypothesis that a genetic diversity index does not differ significantly between HOR and NOR recruits
		15.
Research Projects to evaluate the effectiveness of hatchery program(s)		16. Research project objectives

Sections 1.9 and 1.10. Table

Goal (Section 1.7-1.8)	**Performance Standard** (Section 1.9)	**Performance Indicator** (Section 1.10)
Increase the total abundance of composite natural/hatchery population	The estimate of spawners in natural escapement increases to > 25,000 (Stilly watershed) within 4 generations and on average remains above the goal.	1. Estimate the number of total spawners
Result in an increasing trend of NOR that is estimated to be greater than would have been the case without the project.	The number NOR fish in the naturally spawning population increases in those tributaries that have been reseeded	2. Estimate the number of total NOR spawners in the tributaries that have been reseeded.
	The return per spawner for naturally spawning fish (NRR) remains above replacement level	3. Estimate the recruit per spawner for natural spawners

Section 11.1 Table. First column is taken from Table in section 1.9/1.10

Performance Indicator (Section 1.10)	**Methods/Comments** (Sections 11.1)
1. Estimate total harvest and effort for target fishery	Fish Tickets
2. Estimate the contribution of hatchery fish to harvest in terminal target fishery	Requires a unique tag or mark (fin clip, otolith mark, scale differences) identifying hatchery production. Sampling program in fishery for tags, marks or scales.
3. Estimate exploitation rates of hatchery fish	Requires a unique tag or mark identifying hatchery production Sampling program in all fisher(ies) and escapement for tags or marks
4. Estimate survival of hatchery production to target fisheries and escapement	Requires a unique tag or mark identifying hatchery production Sampling program in all fisher(ies) and escapement for tags or marks
5. Estimate the rate of fertilization and survival from egg to release	Hatchery monitoring plan
6. Count the number of adults used for broodstock.	Hatchery monitoring plan
7. The age and sex composition of the broodstock collected for the hatchery does not differ significantly from the natural spawners	This requires random sampling of the broodstock as well as the naturally spawning population for age and sex.
8. Estimate the timing of the return of adults	This may be carried out using: • a weir • spawning ground surveys stratified over time Once an average spawning time distribution is established, the broodstock collection can be planned so as to distribute it over the range of the migration.
9.	
10. Test the hypothesis that the mean timing of outmigration of hatchery smolts is not significantly different from that of NOR produced smolts	This would require sampling of juveniles using a weir or trap to estimate the timing of the natural outmigration. This might be a short term project to estimate the mean and range of natural outmigration in order to determine the optimum time for hatchery release. Several years would be required to determine the variability of the timing and possibly to evaluate which environmental parameters, if any affect the timing.
11. Test the hypothesis that the mean timing of HOR returning adults is not significantly different from that of NOR returns	This would be affected by several means: • recording of number and type (HOR or NOR) of hatchery returns by time strata • recording of number and type (HOR or NOR) of returns to natural spawning areas by time strata, either in spawner surveys or at a weir.
12. Test the hypothesis that the proportional distribution of HOR spawners is the same as that of NOR	Spawning surveys that are stratified by area and time periods would be needed to collect the data needed for this indicator.
13. Count the number of adults used for broodstock.	Hatchery Monitoring plan

Section 11.1 Table. First column is taken from Table in section 1.9/1.10

Performance Indicator (Section 1.10)	**Methods/Comments** (Sections 11.1)
14. Estimate the percent of HOR fish in the broodstock collected	This will require a method to separate HOR from NOR returning adults e.g. a mass mark or a HOR tag group
15. Test the hypothesis that a genetic diversity index does not differ significantly between HOR and NOR recruits	This will require a genetic sampling plan of HOR and NOR returns.
16. Test the hypothesis that a genetic diversity index does not change significantly over time for NOR recruits	This will require a genetic sampling plan of HOR and NOR returns.
17. Research project objectives	Requires research plan for each project.

Section 11.1 Table. First column is taken from Table in section 1.9/1.10

Performance Indicator (Section 1.10)	**Methods/Comments** (Sections 11 and 12)
1. Estimate the number of total spawners	Estimation of total spawners can be carried out by several methods: • weirs • mark-recapture experiments • stratified surveys and expansions
2. Estimate the number of total NOR spawners	This also requires: • an estimate of the total spawning abundance and, • a method to separate HOR from NOR spawners e.g. a mass mark or HOR tag group.
3. Estimate the recruit per spawner for natural spawners	This estimate can be made if HOR and NOR returns are identified separately in all locations, i.e on the spawning grounds and in the hatchery. If the recruit per spawner is defined as all recruits to fisheries as well as escapement, then estimates of HOR and NOR fishery recoveries will be needed.
4. Estimate the proportion of HOR in natural spawning population	This will require marking the hatchery production and sampling the spawning population to recover the marks. The sampling should be distributed so that all spawners have an equal chance of being sampled for the mark.

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _____ ESU/Population:_____ Activity:___			
Location of hatchery activity:_____ Dates of activity:_____ Hatchery program operato			
Type of Take	**Annual Take of Listed Fish By Life Stage *(Numbe***		
	Egg/Fry	Juvenile/Smolt	Adult
Observe or harass a)		1000	
Collect for transport b)			
Capture, handle, and release c)			
Capture, handle, tag/mark/tissue sample, and release d)			
Removal (e.g. broodstock) e)			
Intentional lethal take f)			
Unintentional lethal take g)			50 coho fishery
Other Take (specify) h) continued from above			30 chum fisher

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.